

# The Air Around You

## Objectives

After this lesson, students will be able to

**I.1.1.1** Describe the composition of Earth's atmosphere.

**I.1.1.2** State how the atmosphere is important to living things.

## Target Reading Skill

**Using Prior Knowledge** Explain that using prior knowledge helps students connect what they already know to what they are about to read.

## Answer

Possible answers include the following:

### What You Know:

1. The atmosphere contains oxygen;
2. Animals breathe oxygen

### What You Learned:

1. The atmosphere contains mostly nitrogen;
2. Ozone is a form of oxygen

## All in One Teaching Resources

- [Transparency I1](#)

## Preteach

## Build Background Knowledge

L2

### Composition of Air

Ask students whether anyone is familiar with the fire triangle, often discussed in fire safety demonstrations. Draw a triangle on the board, and label the corners fuel, heat, and air. Ask: **What do the corners of the triangle represent?** (*The three components needed to produce fire*) Relate the triangle to the composition of air by asking: **What is in air that is needed to produce fire?** (*Oxygen*) Tell students that oxygen is just one component of air that they will learn about in this lesson.

# The Air Around You

## Reading Preview

### Key Concepts

- What is the composition of Earth's atmosphere?
- How is the atmosphere important to living things?

### Key Terms

- weather
- atmosphere
- ozone
- water vapor

## Target Reading Skill

**Using Prior Knowledge** Before you read, look at the section headings and visuals to see what this section is about. Then write what you know about the atmosphere in a graphic organizer like the one below. As you read, write what you learn.

What You Know
1. The atmosphere contains oxygen.
2.




  

What You Learned
1.
2.

Lab zone

## Discover Activity

### How Long Will the Candle Burn?

1. Put on your goggles.
2.  Stick a small piece of modeling clay onto an aluminum pie pan. Push a short candle into the clay. Carefully light the candle.
3.  Hold a small glass jar by the bottom. Lower the mouth of the jar over the candle until the jar rests on the pie pan. As you do this, start a stopwatch or note where the second hand is on a clock.
4. Watch the candle carefully. How long does the flame burn?
5.  Wearing an oven mitt, remove the jar. Relight the candle and then repeat Steps 3 and 4 with a larger jar.

### Think It Over

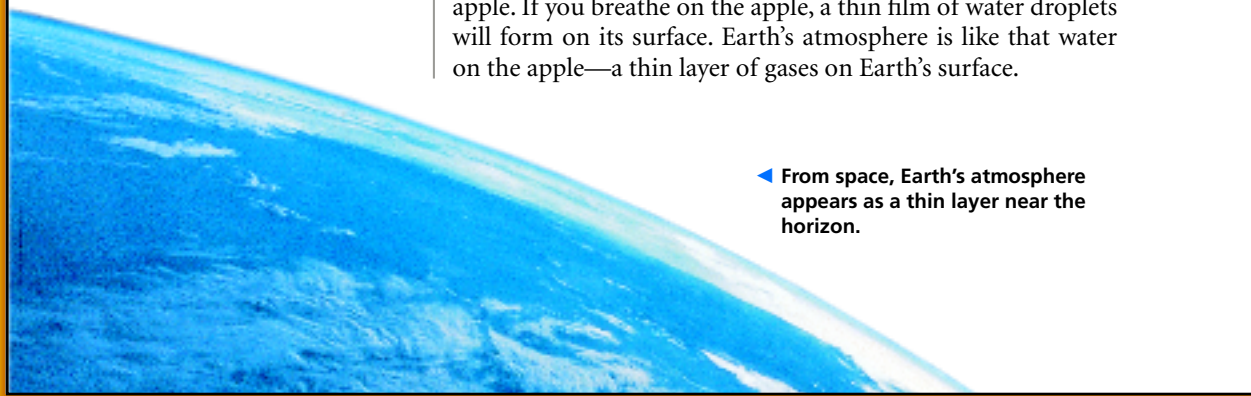
**Inferring** How would you explain any differences between your results in Steps 4 and 5?



The sky is full of thick, dark clouds. In the distance you see a bright flash. Thirty seconds later, you hear a crack of thunder. You begin to run and reach your home just as the downpour begins. That was close! From your window you look out to watch the storm.

Does the weather where you live change often, or is it fairly constant from day to day? **Weather** is the condition of Earth's atmosphere at a particular time and place. But what is the atmosphere? Earth's **atmosphere** (AT muh sfeer) is the envelope of gases that surrounds the planet. To understand the relative size of the atmosphere, imagine that Earth is the size of an apple. If you breathe on the apple, a thin film of water droplets will form on its surface. Earth's atmosphere is like that water on the apple—a thin layer of gases on Earth's surface.

◀ From space, Earth's atmosphere appears as a thin layer near the horizon.



Lab zone

## Discover Activity

### Skills Focus Inferring

L1

**Materials** safety goggles, modeling clay, aluminum pie pan, short candle, matches, small glass jar, stopwatch or watch with second hand, oven mitt, large glass jar

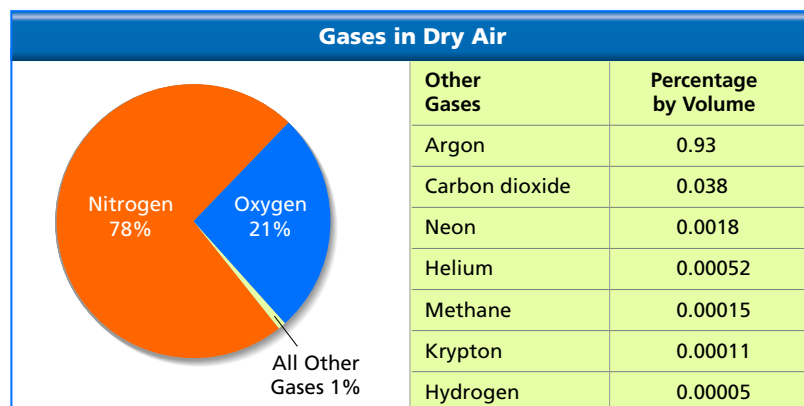
**Time** 15 minutes

**Tips** You can use beakers instead of jars for this activity. You may wish to have

students practice using the stopwatches before they begin the activity.

**Expected Outcome** The candle will quickly burn out under the small jar and will burn somewhat longer under the large jar.

**Think It Over** The gas needed for the candle to burn is oxygen. The candle burned longer under the large jar because the large jar contained more oxygen.



**FIGURE 1**  
Dry air in the lower atmosphere generally has about the same composition of gases.  
**Interpreting Data**  
What two gases make up most of the air?

## Composition of the Atmosphere

The atmosphere is made up of a mixture of atoms and molecules of different kinds. An atom is the smallest unit of a chemical element that can exist by itself. Molecules are made up of two or more atoms. **Earth's atmosphere is made up of nitrogen, oxygen, carbon dioxide, water vapor, and many other gases, as well as particles of liquids and solids.**

**Nitrogen** As you can see in Figure 1, nitrogen is the most abundant gas in the atmosphere. It makes up a little more than three fourths of the air we breathe. Each nitrogen molecule consists of two nitrogen atoms.

**Oxygen** Even though oxygen is the second most abundant gas in the atmosphere, it makes up less than one fourth of the volume. Plants and animals take oxygen directly from the air and use it to release energy from their food.

Oxygen is also involved in many other important processes. Any fuel you can think of, from the gasoline in a car to the candles on a birthday cake, uses oxygen as it burns. Without oxygen, a fire will go out. Burning uses oxygen rapidly. During other processes, oxygen is used slowly. For example, steel in cars and other objects reacts slowly with oxygen to form iron oxide, or rust.

Most oxygen molecules have two oxygen atoms. **Ozone** is a form of oxygen that has three oxygen atoms in each molecule instead of the usual two. Have you ever noticed a pungent smell in the air after a thunderstorm? This is the odor of ozone, which forms when lightning interacts with oxygen in the air.



What is ozone?

**FIGURE 2**  
**Burning Uses Oxygen**  
Oxygen is necessary in order for the wood to burn.



## Instruct

## Composition of the Atmosphere

### Teach Key Concepts

L2

#### Atmospheric Gases

**Focus** Ask: What is the most abundant gas in the atmosphere? (Many students might respond "oxygen.")

**Teach** Explain that the atmosphere is made of gases, solids, and liquids, but mostly gases. Ask: **What are the most abundant gases?** (Nitrogen and oxygen) **Why is oxygen important?** (It is essential to plants and animals; it is also involved in processes such as fire.) Refer students to Figure 1. Ask: **What percentage of air is made of carbon dioxide?** (0.038 percent)

**Apply** Ask: **Do the percentages of gases in the atmosphere change?** (Yes, to some extent. The amount of water vapor in the air varies over time and from place to place and the concentration of carbon dioxide has increased steadily over the past 200 years. However, in broad terms the composition of the atmosphere is fairly stable.) **learning modality: logical/mathematical**

### Help Students Read

L1

**Active Comprehension** Refer to the Content Refresher for guidance in active comprehension. Ask: **What would you like to know about what air is made of?** Write students' questions on the board. Have students answer the questions as they finish reading the section.

### Independent Practice

L2

#### All in One Teaching Resources

- [Guided Reading and Study Worksheet: The Air Around You](#)
- [Transparency I2](#)

Student Edition on Audio CD

## Differentiated Instruction

### English Learners/Beginning

L1

**Vocabulary: Link to Visual** Explain and clarify the meaning of atmosphere by discussing the thin layer of atmosphere visible in Figure 1. Have students write the word "atmosphere" in a circle. Then have them list the components of the atmosphere around the circle as you read through the section. **learning modality: visual**

### English Learners/Intermediate

L2

**Vocabulary: Science Glossary** Have students write the definitions for the key terms in this section, and then write a sentence that uses each of these words. Call on individuals to read their sentences aloud. **learning modality: verbal**

## Monitor Progress

L2

**Oral Presentation** Call on students to state ways that the atmosphere contributes to life on Earth.

### Answers

**Figure 1** Nitrogen and oxygen



A form of oxygen that has three oxygen atoms in each molecule



## Inferring Amount of Oxygen in the Atmosphere

**Materials** tall glass jar, large cake pan, clean steel wool, water, tape

**Time** 5 minutes on each of two days

**Focus** Tell students that this activity will demonstrate the percentage of oxygen in the atmosphere.

**Teach** Have students fill a cake pan almost full of water. Then have them push the steel wool down into the bottom of the jar so it will not fall out when the jar is turned over. **CAUTION:** Remind students to handle glass carefully. Have students fill the jar with water, cover the mouth with one hand, and place the jar upside down in the cake pan. Then students should remove the hand and tilt the jar slightly to let out enough water to make the water level in the jar just above the water level in the pan. Have students mark the water level in the jar with tape. Students should check the water level in the jar the next day. It should be about one fifth higher.

**Apply** Explain that oxygen in the air combines with iron in steel wool to form rust. Ask: **How much oxygen would you estimate is in air?** (About one fifth of the air was used up, so the air must be about one fifth oxygen.) **learning modality: logical/mathematical**

## Importance of the Atmosphere

### Teach Key Concepts

#### Living Things and the Atmosphere

**Focus** Review why oxygen is important.

**Teach** Ask: **How does life on Earth depend on the atmosphere?** (The atmosphere contains gases that living things need, keeps the surface warm, protects living things from dangerous radiation, and prevents the surface from being hit by most objects from outer space.)

**Apply** Ask: **If the composition or thickness of the atmosphere changed, how might life on Earth be affected?** (Possible answer: Many living things could not survive if the amount of oxygen decreased greatly.) **learning modality: logical/mathematical**

FIGURE 3


**Water Vapor in the Air** There is very little water vapor in the air over the desert where this lizard lives. In the tropical rain forest (right), where the frog lives, as much as four percent of the air may be water vapor.



### Lab zone Try This Activity

#### Breathe In, Breathe Out

How can you detect carbon dioxide in the air you exhale?

1. Put on your goggles.
2. Fill a glass or beaker halfway with limewater.
3.  Using a straw, slowly blow air through the limewater for about a minute. **CAUTION:** Do not suck on the straw or drink the limewater.
4. What happens to the limewater?

#### Developing Hypotheses

What do you think would happen if you did the same experiment after jogging for 10 minutes? What would your results tell you about exercise and carbon dioxide?

**Carbon Dioxide** Each molecule of carbon dioxide has one atom of carbon and two atoms of oxygen. Carbon dioxide is essential to life. Plants must have carbon dioxide to produce food. When the cells of plants and animals break down food to produce energy, they give off carbon dioxide as a waste product.

When fuels such as coal and gasoline are burned, they release carbon dioxide. Burning these fuels increases the amount of carbon dioxide in the atmosphere.

**Other Gases** Oxygen and nitrogen together make up 99 percent of dry air. Argon and carbon dioxide make up most of the other one percent. The remaining gases are called trace gases because only small amounts of them are present.

**Water Vapor** So far, we have discussed the composition of dry air. In reality, air is not dry because it contains water vapor. **Water vapor** is water in the form of a gas. Water vapor is invisible. It is not the same thing as steam, which is made up of tiny droplets of liquid water. Each water molecule contains two atoms of hydrogen and one atom of oxygen.

The amount of water vapor in the air varies greatly from place to place and from time to time. Water vapor plays an important role in Earth's weather. Clouds form when water vapor condenses out of the air to form tiny droplets of liquid water or crystals of ice. If these droplets or crystals become heavy enough, they can fall as rain or snow.

**Particles** Pure air contains only gases. But pure air exists only in laboratories. In the real world, air also contains tiny solid and liquid particles of dust, smoke, salt, and other chemicals. You can see some of these particles in the air around you, but most of them are too small to see.



What is water vapor?

### Lab zone Try This Activity

**Skills Focus** Developing hypotheses

**Materials** goggles, glass or beaker, limewater, straw

**Time** 15 minutes

**Tips** This activity can be done as a demonstration.

**Expected Outcome** Limewater will become cloudy as  $\text{CO}_2$  reacts with the

calcium hydroxide in the water. The cloudiness is caused by the formation of calcium carbonate, or limestone.

**Extend** Allow the cloudy water to stand undisturbed for several hours. The calcium carbonate will fall to the bottom of the beaker. **learning modality: visual**



Go Online  
PHSchool.com

For: Links on  
atmosphere  
Visit: PHSchool.com  
Web Code: scn-0911

Students can review the importance of the atmosphere in online activities.

## Importance of the Atmosphere

Earth's atmosphere makes conditions on Earth suitable for living things. The atmosphere contains oxygen and other gases that you and other living things need to survive. In turn, living things affect the atmosphere. The atmosphere is constantly changing, with gases moving in and out of living things, the land, and the water.

Living things need warmth and liquid water. By trapping energy from the sun, the atmosphere keeps most of Earth's surface warm enough for water to exist as a liquid. In addition, Earth's atmosphere protects living things from dangerous radiation from the sun. The atmosphere also prevents Earth's surface from being hit by most meteoroids, or rocks from outer space.

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For: Links on atmosphere  
Visit: [www.SciLinks.org](http://www.SciLinks.org)  
Web Code: scn-0911

## Section 1 Assessment

**Target Reading Skill Using Prior Knowledge**  
Review your graphic organizer and revise it based on what you just learned in the section.

### Reviewing Key Concepts

- a. Defining** What is the atmosphere?  
**b. Listing** What are the four most common gases in dry air?  
**c. Explaining** Why are the amounts of gases in the atmosphere usually shown as percentages of dry air?
- a. Describing** What are three ways in which the atmosphere is important to life on Earth?

- b. Predicting** How would the amount of carbon dioxide in the atmosphere change if there were no plants?
- c. Developing Hypotheses** How would Earth be different without the atmosphere?

## Writing in Science

**Summary** Write a paragraph that summarizes in your own words how oxygen from the atmosphere is important. Include its importance to living things and in other processes.

## Lab Zone Chapter Project

**Keep Students on Track** Advise students to determine how, where, and when they will make their observations, and organize a notebook in which to record them. Encourage students to observe several different weather variables. They can begin recording the date, time, and place of each observation and any unusual weather events, such as violent storms.

## Writing in Science

**Writing Mode** Description

### Scoring Rubric

- 4 Exceeds criteria, includes complete description of why oxygen is important to living things and other processes; provides detailed examples
- 3 Meets all criteria, but does not include detailed examples
- 2 Includes only brief description
- 1 Is inaccurate and incomplete

## Monitor Progress L2

### Answer



Water in the form of a gas

## Assess

### Reviewing Key Concepts

- a.** A thin layer of gases that surrounds Earth **b.** Nitrogen, oxygen, argon, carbon dioxide **c.** The percentage of water vapor in the air varies and affects the percent composition.
- a.** The atmosphere contains oxygen needed by many organisms, provides warmth by trapping energy from the sun, and protects living things from dangerous radiation and objects from outer space.  
**b.** Carbon dioxide would increase without plants. **c.** Answers may vary, but there would probably be no life on Earth.

### Reteach L1

Have student groups make a chart describing the main components of the atmosphere.

### Performance Assessment L2

**Writing** Have students write a paragraph that describes what water vapor is, how it plays a role in Earth's weather, and how the amount of water vapor in the air varies.

### All in One Teaching Resources

- [Section Summary: The Air Around You](#)
- [Review and Reinforce: The Air Around You](#)
- [Enrich: The Air Around You](#)